

Probopyrus insularis*, a new species (Isopoda: Bopyridae), a parasite of *Macrobrachium faustinum* (Saussure de, 1857) (Decapoda: Palaemonidae), with criteria to differentiate species of *Probopyrus

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Abstract.—*Probopyrus insularis* n. sp. parasiting *Macrobrachium faustinum* (Saussure de, 1857) from the Caribbean Islands is mainly distinguished by the shape of the: pleotelson in both sexes; carina of the seventh legs in females; palp of the maxillipeds in females; and pleon in males. Characters used to distinguish species of *Probopyrus* Giard & Bonnier, 1888 are discussed.

Two new American species of *Probopyrus* recently have been described as part of an ongoing taxonomic study of these parasitic isopods. *Probopyrus pacificensis* Román-Contreras, 1993, and *P. markhami* Román-Contreras, 1996, both were described from the west coast of Mexico. Here a new *Probopyrus* parasitizing *Macrobrachium faustinum* (Saussure de, 1857) from Jamaica, Puerto Rico, Guadeloupe and Cuba is described. Other American species new to science are expected as taxonomic research continues.

Holthuis (1977) recorded *M. faustinum* parasitized by “bopyrids” from Cuba; and Kensley & Schotte (1989), and Bunkley-Williams & Williams (1998) have assigned *M. faustinum* as host of *Probopyrus pandalicola* (Packard, 1879). These records, however, might be a misidentification of the new species described here. *Macrobrachium faustinum*, the only host known for this new species, has been reported from the United States, Venezuela and the Antilles by Chace & Hobbs Jr. (1969), Holthuis & Provenzano (1970), Chace (1972), Dugger & Dobkin (1975), Pereira (1991), Fièvet (1998, 1999a, 1999b, 2000), Fièvet et al. (1996, 1999) and Bowles et al. (2000). The new isopod may be present in these areas.

In a previous paper Román-Contreras (1993) summarized and proposed a series of diagnostic characters for the genus *Probopyrus*. These characters are updated and applied to this description (Tables 1 and 2).

Genus *Probopyrus* Giard & Bonnier, 1888
Probopyrus insularis, new species
Figs. 1–22

Holotype female.—USNM 120073. Allotype male USNM 306876, prepared for SEM; C. W. Hart Jr. coll., 7 Jan 1960, Tributary of Trunnels River, St. Mary Parish, Jamaica.

Other material examined.—USNM 235988: one young female, Río Cruces, 1500 m W of Sabana Grande, Puerto Rico. USNM 235990: one female, one male, 8 May 1953, Río Lajas, 3000 m S of Vega Alta, Puerto Rico. USNM 63309: one female, one male, J. C. Welsh Jr. coll., Cuba. One female, one male, Serre coll., 1910, Cuba (in the Muséum National d’Histoire Naturelle, Paris). Twenty one females and males, Y. Thèrèzien coll. and det. hosts, 2 Dec 1977, Belle Eau, village de l’Habituée, Guadeloupe. Ten females, eight males, Y. Thèrèzien coll. and det. hosts, 30 Oct 1978, Lèzarde estuary, Guadeloupe. Twenty nine

females, 26 males, E. Fièvet coll. and det. hosts, Dec 1996, Bananie River, Guadeloupe. Material from Guadeloupe deposited at collections of the authors.

Type locality.—Tributary of Trunnels River, St. Mary Parish, Jamaica.

Distribution.—Jamaica, Puerto Rico, Cuba, and Guadeloupe.

Host for all specimens.—*Macrobrachium faustinum*.

Habitat.—Freshwater.

Description of holotype female.—Length 10.3 mm, from border of first pereonite to tip of sixth pleonite; maximal width at third pereonite, 7 mm. Distortion angle 26° , outline pyriform (Figs. 1, 2). Head almost as wide as long, front rounded, posterior border deeply inserted into first pereonite, surface smooth. No well defined frontal lamina, indicated by only a narrow line; anterolateral corners of head produced into slight rounded tips. Antennula and antenna bisegmented; antennula ovoid, 4–5 spines on distal tip; antennae smaller than antennulae, basal portion wider than antennulae, distal one subspheric-shape (Fig. 3); both antennae with small dispersed pectinate scales on surface. Maxilliped bisegmented, subovoid, anterolaterally convex, nonsetose palp formed by two digitiform processes (Fig. 4). Three pairs of smooth, lamellar projections on barbula; inner lateral projections lanceolate, outer ones slightly larger and wider, third one smaller than former and beneath them; middle region rounded (Fig. 5); eyes absent. Pereonites dorsally distinct; border of pereonites 1–4 produced into distinct dorsolateral bosses, coxal plates narrow (Fig. 2). Oostegites completely surrounding but not enclosing marsupium; oostegite 1 relatively large, partially covering head and anterior part of brood pouch; anterior segment transversely ovoid and concave, frontal border rounded and slightly undulate; distal segment digitiform, larger axis perpendicular to the former; digitiform process on inner ridge, distal portion smooth, small spines on inner border; reticulated black pigmentation on surface, ex-

cept on distal portion (Fig. 6). Oostegites 2–4 progressively longer; oostegites 3–4 on larger side unpigmented; fifth oostegites longer than others, slightly falcate, ending in blunt tip, densely setose along posterior margin, extending across posterior region of marsupium and overlapping each other. Pereopods with massive basipodite, dactylus hook shape (Fig. 7). Robust high carina on pereopods, either rectangular (P1–P2), convex (P3–P4) or subquadrangular (P5–P7) (Fig. 8). Pigmentated spots on basis of pereopods 1–5 on short side; basis of pereopods 6–7 on short side, and 1–7 on larger side, unpigmented. Pleon 0.3 times body length, five dorsal and laterally separated pleonites; lateral plates lamellar, almost rounded or slightly truncated. Pleotelson bell-shaped, relatively small, bilobated, deep fissure in the middle, lobes unseparated, tips shorter than the fifth lateral plates (Fig. 2). Five pairs of biramous foliate pleopods completely covering ventral surface of pleon, each different in shape and size; exopods on large side enlarged, increasing in length from first to fifth, protruding notably from tips of pleon (Figs. 1, 2, 15); endopods decreasing in size from first to fifth; larger exopods on opposite side slightly rippled (Fig. 9); uropods absent.

Description of male.—Length 1.84 mm, width 0.6 mm; body unpigmented. Head twice as wide as long, slightly depressed at middle (Figs. 10, 12, 13); posterior margin almost straight, anterolateral borders rounded. Antennae different in size and shape; antennula three-segmented, bottle-shape, proximal portion globose, upper portion small, button shape, eight obscure small spines on tip. Antenna bisegmented, slightly smaller and thinner than antennula, cylindrical, with short proximal basis; stout short setae on tip of distal article. Both antennae with small pyramidal or rounded pectinate scales on surface (Fig. 11). Maxillipeds absent. No eyes. Pereon wider at second pereonite, 4–7 progressively shorter; tips of pereonites subglobose, reflexed ventrally, small scales on ventral surface; midventral tubercles ab-

Table 1.—Morphological comparative characters for the American species of *Probopyrus* (Females). (Hosts: *M.* = *Macrobrachium*, *P.* = *Palaemonetes*, *Pa.* = *Palaemon*).^a

| Species/host | Characters | | | | | |
|--------------------------------------------------|----------------------------|---------------------------------|---------------------|-------------------------------|-----------------------------------------|--------------------------|
| | Body shape | Concavity on short side of body | Body, distal region | Pigmentation on pereopods 2-4 | Cephalon: shape of the posterior region | Cephalon: frontal border |
| <i>P. insularis</i> <i>M. faustinum</i> | Pyriform | Present | Pointed | On short side | Rounded, ovoid, or subtriangular | Convex |
| <i>P. bithynis</i> / <i>M. ohionis</i> (sic) | Pyriform | Present | Pointed | On short side | Triangular | Right |
| <i>P. bithynis</i> / <i>M. olfersii</i> | | | | | | |
| <i>P. markhami</i> <i>M. americanum</i> | Ovoid or pyriform | Absent | Rounded | On short side | Subpentagonal | Right |
| <i>P. meeki</i> / <i>M. acanthurus</i> | Pyriform | Slight | Rounded | Absent | Ovoid | Convex |
| <i>P. pacificensis</i> <i>M. tenellum</i> | Pyriform | Present | Pointed | On short side | Ovoid | Right |
| <i>P. panamensis</i> <i>M. acanthurus</i> | Pyriform | Present | Pointed | On short side | Ovoid | Convex |
| <i>P. floridensis</i> <i>P. paludosus</i> | Pyriform or ovoid | Present or absent | Pointed | On short side | Ovoid or triangular | Right or acute |
| <i>P. pandalicolal</i> <i>P. hiltonii</i> | Pyriform | Slight | Rounded | On 2 sides | Rounded | Convex |
| <i>P. pandalicolal</i> / <i>P. pugio</i> | Ovoid | Absent | Rounded | On 2 sides | Rounded or ovoid | Right or convex |
| <i>P. pandalicolal</i> <i>P. vulgaris</i> | Pyriform, ovoid or rounded | Present or absent | Pointed or rounded | On 2 sides | Rounded or triangular | Right or convex |
| <i>P. ringueletii</i> <i>P. argentinus</i> | Ovoid | Absent | Pointed | | Ovoid | Acute |
| <i>P. palaemonii</i> <i>Pa. pandaliformis</i> | Ovoid | Absent | Pointed or rounded | On 2 sides | Rounded or triangular | Right or convex |

^a Sources: see Table 2.

sent. Isomorphic pereopods, larger posteriorly, uncarinated. Pleon outline subtriangular, slightly narrower than seventh pereonite, distinct pleonites separated laterally; four pairs of sessile ovoid pleopods conspicuous in ventral view; gross pleotelson triangular shape, wide basis and rounded tip (Fig. 10); uropods absent.

Etymology.—The specific name refers to the Caribbean islands, where the examined specimens were collected.

Variation in female specimens.—In younger specimens the cleft of the pleotelson is open V-shaped, and the tips of the lobes reach to or beyond the tips of the fifth pleonite (Fig. 15). Size and shape of the carina of the pereopods varies according to

its position. In *P. insularis* the shape of the carina is rectangular in P1–P2, convex in P3–P4, or subquadrangular in P5–P7, increasing its size behind.

In adult specimens the palp of the maxilliped usually is prominent and finger-like, sometimes with a pair of distal setae; in other specimens the shape of the maxilliped is subquadrangular, rudimentary, reduced to a small, acute, lateral point, or bearing two digital processes directed outward.

Variation in males.—The body shape and size in males varies with the state of development (Figs. 12–14). The pleon in *P. insularis* is composed by four or five pleonites, depending upon the state of development, which are differentiated dorsally and

Table 1.—Extended.

| Palp of maxilliped & number of setae | Height & Shape of the carina | Characters | | | |
|-----------------------------------------|------------------------------------|-----------------------------------------|----------------------------------------------|------------------------------------------|-------------|
| | | Pleopods: length | Pleopods: protrusion from border of pleon | Pleotelson | Uropods |
| Digitiform; 2 setae | Extremely high, subquadrangular | Exopodite large, endopodite small | Protruding far | Fissured, lobes not separated | Absent |
| | Extremely high, quadrangular | Small | Protruding slightly | Entire, notched | Absent |
| Pyramidal or ovoid; 4 setae | Extremely high, rounded | Small | Diminished | Notched | Present |
| | Medium, rounded | | Not protruding | Fissured | Rudimentary |
| Ovoid, 8–10 setae | High, rounded | Small | Protruding far | Entire or slightly notched | Absent |
| | High, rounded | Small | Not protruding | Slightly notched | Absent |
| | Medium, rounded | Small or subequal | Protrusion variable | Entire or notched | |
| Ovoid, 8–10 setae | | | | Notched | |
| | | Small | Not protruding or only slightly | Entire or notched | |
| | High, quadrangular | Small | Not protruding or far | Entire (right/ rounded) or notched | |
| Ovoid, undetermined | High, rounded | Exopodite large, endopodite small | Diminished | Notched | Absent |
| Ovoid, 3 setae | | Small | Protruding slightly or not | Bilobated | |

laterally, but sometimes the pleonites are differentiated only laterally.

The shape of the pleotelson in males of *P. insularis* can be subtriangular, subovoid, subrounded, irregularly shaped, fused central and laterally with the previous pleonite on one or both sides but invariably bulbous and blunt, directed behind or laterally.

Description of the epicaridium larva.—Body length: 0.18 to 0.25 mm; length width ratio from 1.7 to 2.3. Antenna large, six segmented, reaching between the second and sixth pleonites; segments 1–4 large; distal seta on internal face of fourth, fifth and sixth segments thinner than others. Distal segment bordered by three small spines and two large unequal setae (Fig. 16). Maxillipeds not distinguishable. Pereopods sub-

equal and dimorphic; first three pairs robust (Fig. 17); other three thinner (Fig. 18). Posteroventral border of fifth pleonite finely denticulate (Fig. 19); ventral side of sixth pleonite formed of plates. First pleopod with basal plate and a long, thin, curved external ramus ending in three long feathered setae. Posteromedial corner of basipodite of pleopod 1 with large feathered setae (Fig. 20). This seta absent in following three pairs of pleopods, and replaced in fifth the length of the exopodite. Fifth pair unsegmented, basipodite semi-rounded, exopodite ending in three short feathered setae (Fig. 21). Uropods of two equal branches ending in two denticles and one strong median seta (Fig. 22); anal tube small.

Table 2.—Morphological comparative characters for the American species of *Probopyrus* (Males). (Hosts: *M.* = *Macrobrachium*, *P.* = *Palaemonetes*, *Pa.* = *Palaemon*).

| Species/host | Characters | | | Source |
|------------------------------------------------|---------------------------------------|----------------------------------|------------------------------------------------------------------------------|------------------------|
| | Shape of pleon | Shape of pleotelson | | |
| <i>P. insularis</i> / <i>M. faustinum</i> | Scutelliform or subtriangular | Subtriangular, digitiform, bulky | Present work | Richardson, 1904; 1905 |
| <i>P. bithynis</i> / <i>M. ohionis</i> (sic) | Semicircular or ovoid | Rounded, entire or fissured | | |
| <i>P. bithynis</i> / <i>M. olfersii</i> | | | | |
| <i>P. markhami</i> / <i>M. americanum</i> | Subtrapezoidal | Rounded | Román-Contreras, 1996 | |
| <i>P. meeki</i> / <i>M. acanthurus</i> | Semicircular | Button rounded | Richardson, 1912 | |
| <i>P. pacificensis</i> / <i>M. tenellum</i> | Semicircular | Button rounded | Román-Contreras, 1993 | |
| <i>P. panamensis</i> / <i>M. acanthurus</i> | Semicircular | Rounded | Richardson, 1912 | |
| <i>P. floridensis</i> / <i>P. paltudosus</i> | Semicircular | Rounded or bare-necked | Richardson, 1904; 1905 | |
| <i>P. pandalicola</i> / <i>P. hiltonii</i> | Semicircular | Rounded | Jiménez and Vargas, 1990 | |
| <i>P. pandalicola</i> / <i>P. pugio</i> | Variable | Rounded | Markham, 1985 | |
| <i>P. pandalicola</i> / <i>P. vulgaris</i> | Semicircular, posterior edge truncate | Rounded or triangular | Packard, 1879; Gissler, 1882; Bonnier, 1900; Richardson, 1905; Markham, 1985 | |
| <i>P. ringueleti</i> / <i>P. argentinus</i> | Slightly rounded | Rounded or truncate | Verdi and Schuldt, 1988 | |
| <i>P. palaemoni</i> / <i>Pa. pandaliformis</i> | Wide, semicircular | Rounded, fissured or bilobulated | Lemos de Castro and Brasil Lima, 1974 | |

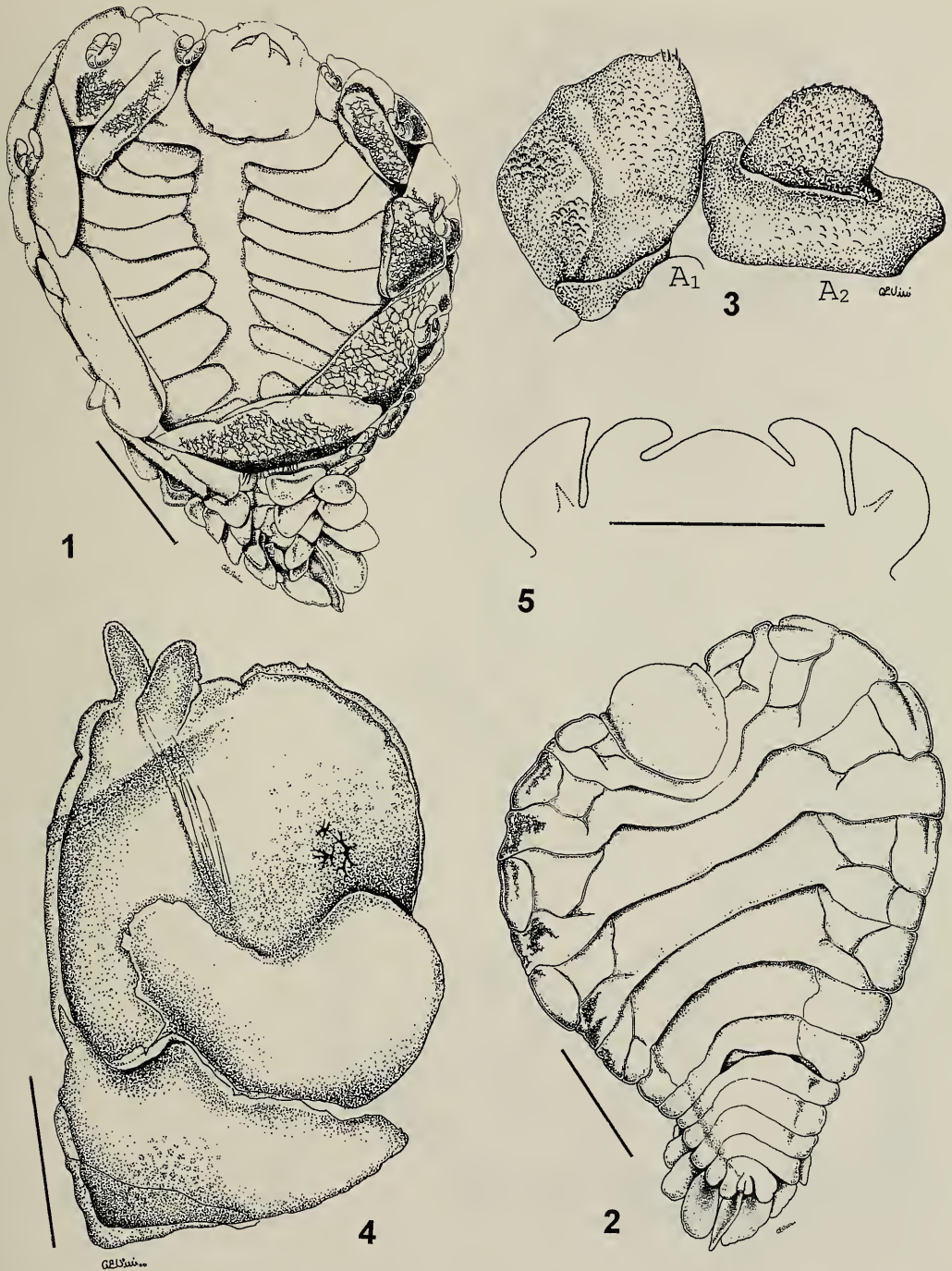
Discussion

The use of host selectivity, pigmentation patterns, habitat, behavior, morphological structures, and statistical methods to differentiate species in the genus *Probopyrus* have been discussed in a recent paper by Román-Contreras (1993, 1996). The following morphological characters that should be described carefully in to differentiating species have been discussed by Giard & Bonnier (1888), Bonnier (1900), Richardson (1904, 1905, 1912), Chopra (1923), and Román-Contreras (1993, 1996).

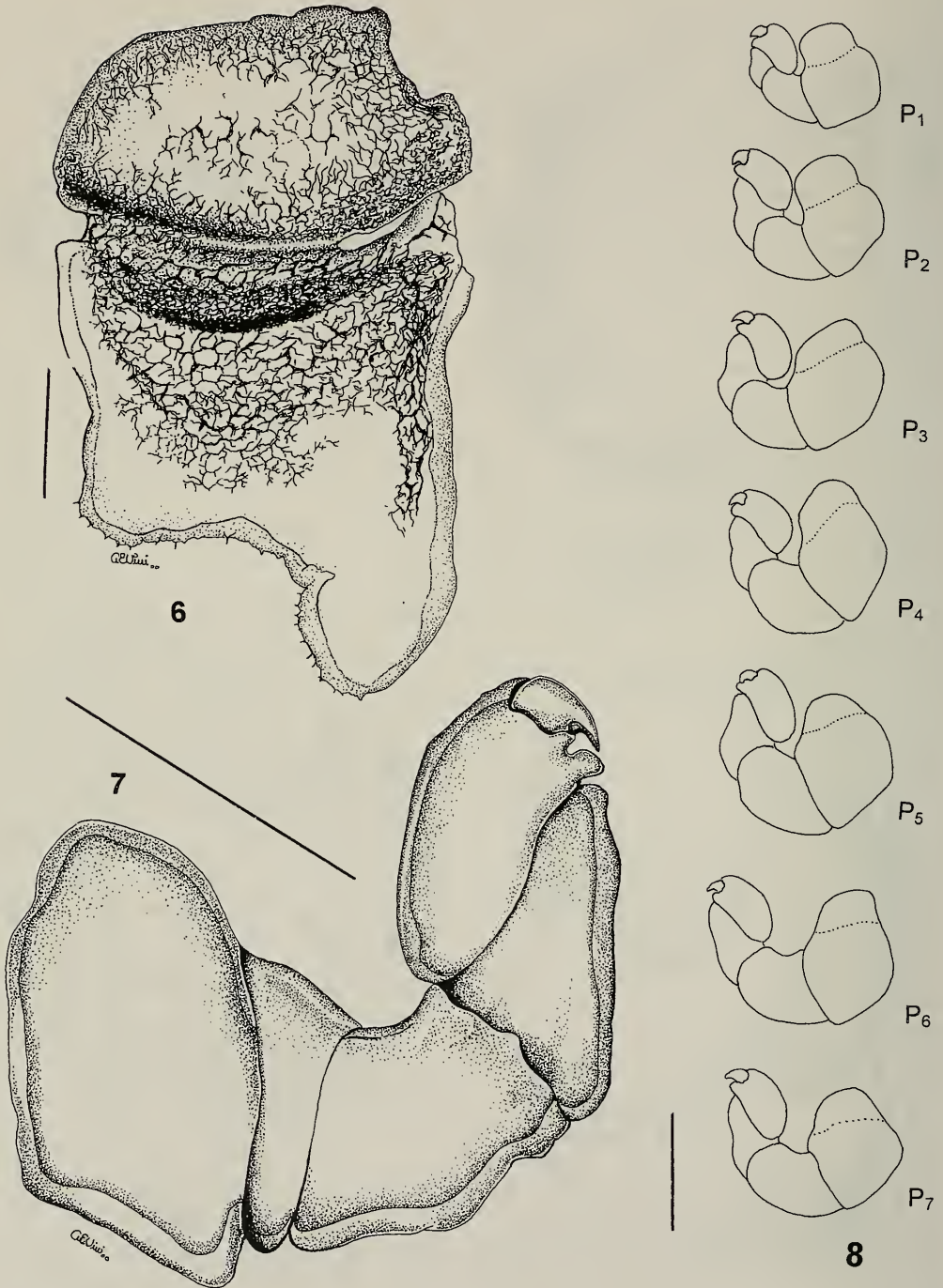
Females of *P. insularis* can be differentiated from other American species of *Probopyrus* by their relatively short and narrow pleotelson. In adult specimens a deep fissure with rounded and unseparated lobes is present; usually the edge of the lobes do not reach the tip of the fifth pleonite. The shape of the female pleotelson of *P. insularis* is similar only to *P. meeki* Richardson, 1912. However, the sixth segment of *P. meeki* has a posterior notch that extends half of its length and forming two posterior unseparated lobes (Richardson, 1912: fig. 1).

The robust carina of the seventh leg of *P. insularis* is comparable to the high and prominent carina of *P. markhami*. All legs of *P. bithynis* Richardson, 1904 have an extremely high carina (Richardson 1904, 1905). The legs of *P. pandalicola* have a high quadrangular-shaped carina, while the carina of *P. floridensis* Richardson, 1904 are rounded (Richardson 1912). Román-Contreras (1993, 1996) noted the rounded carina of *P. pacificensis*.

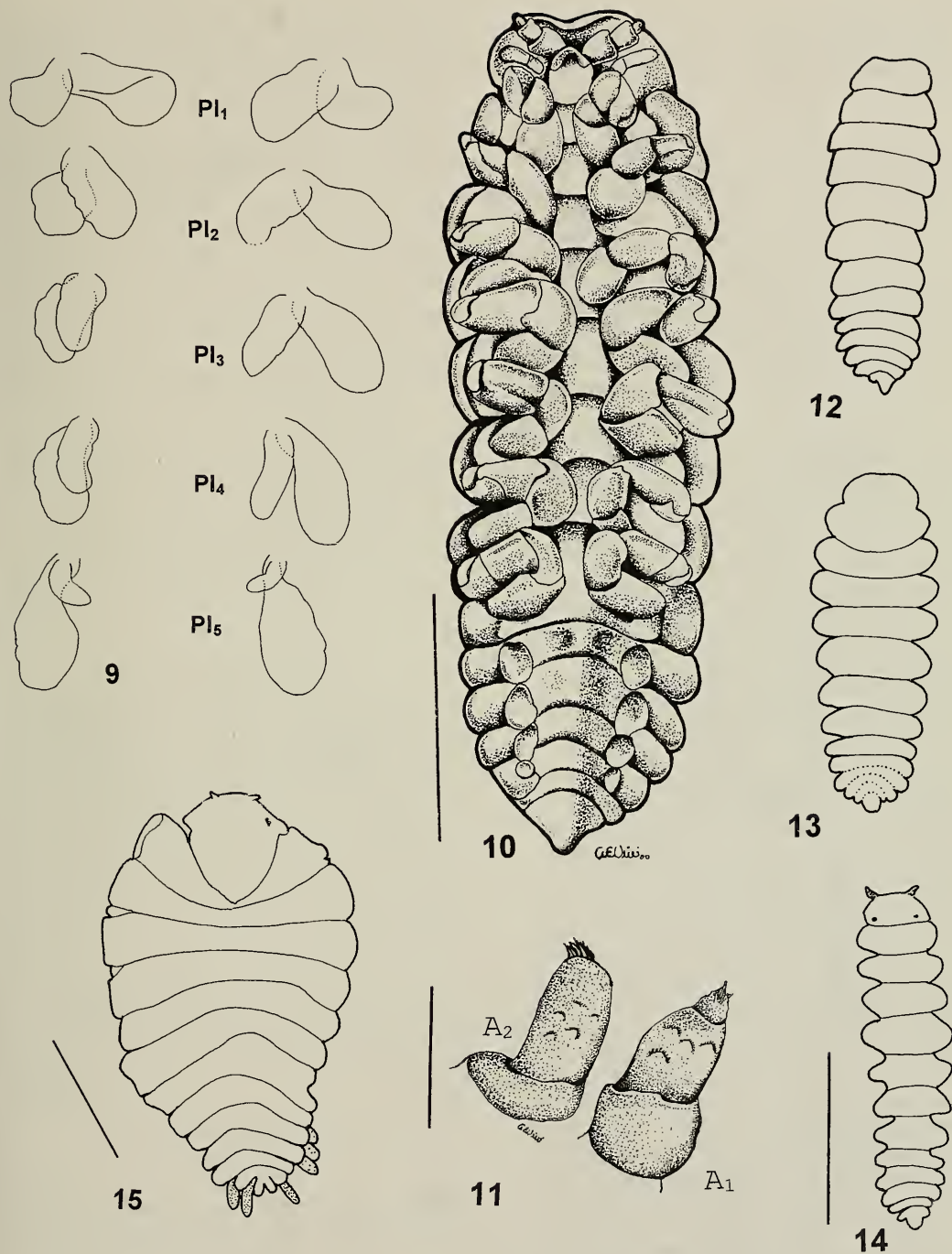
Although the maxilliped palp of *Probopyrus* may vary according to the developmental state of the specimens, the morphology has proven valuable in separating species. The maxilliped palp of adult females of *P. insularis* is finger-like in most specimens (79%); a small percentage (14%) have two setae on the tip or no palp is present; few individuals have a triangular, a rounded, or a rudimentary palp. For *Probopyrus ringueleti* Verdi & Schuldt, 1988,



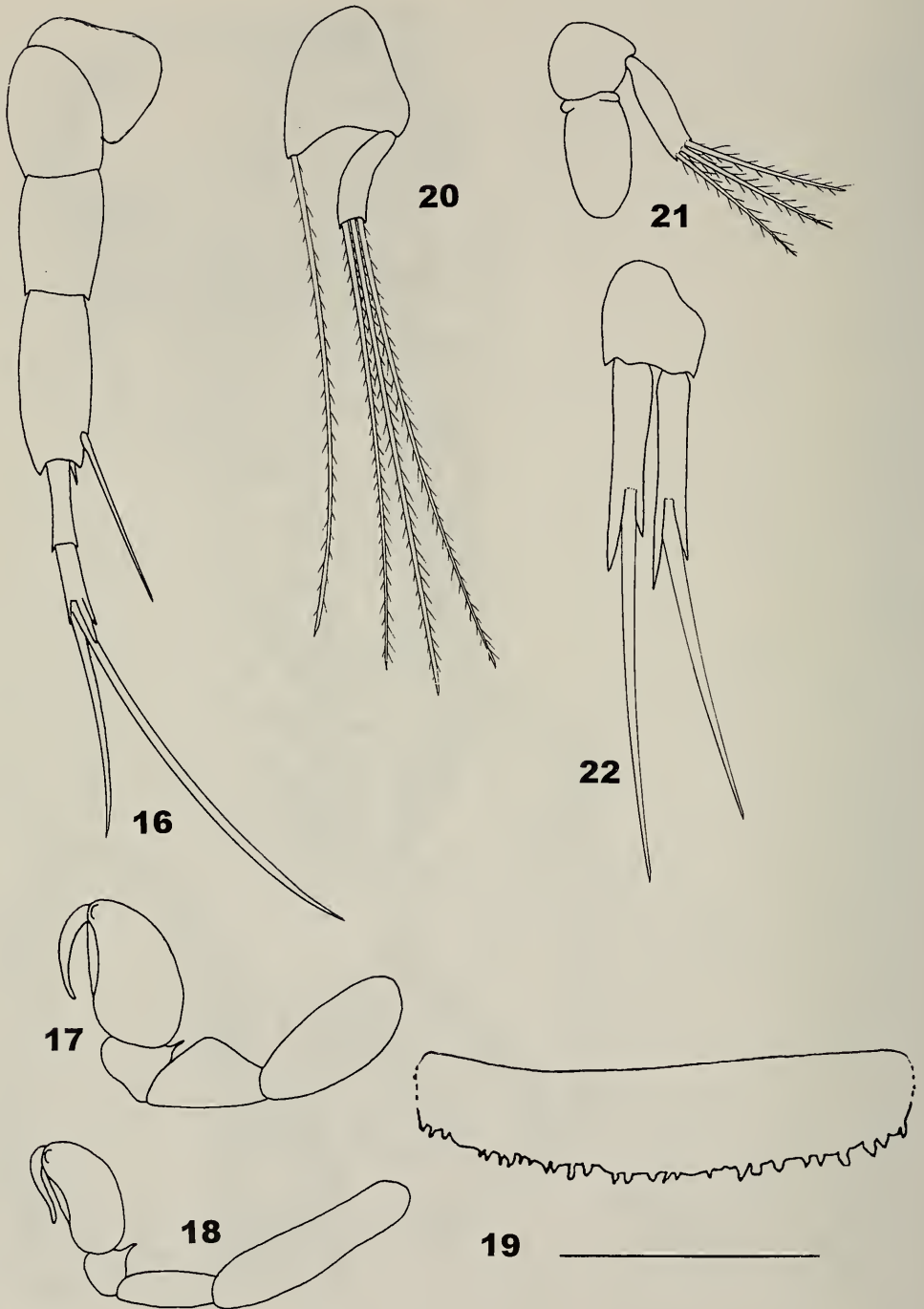
Figs. 1-5. Holotype female of *Probopyrus insularis* sp. nov. 1), in ventral view (oostegite I and barbula removed); 2), same in dorsal view; 3), antennula and antenna from a paratype specimen (picture taken with scanning electron microscopy: SEM); 4), maxilliped in dorsal view; 5), barbula of a paratype. Scale bar: 1 and 2 = 2.0 mm; 4 = 0.5 mm; 5 = 1.0 mm.



Figs. 6-8. *Probopyrus insularis* sp. nov. 6), oostegite 1 in dorsal view; 7), pereopod 7 of holotype female; 8), pereopods 1-7 of paratype female. Scale bar: 6 and 15 = 1.0 mm; 7 = 0.5 mm.



Figs. 9–15. *Probopyrus insularis* sp. nov. 9), pleopods 1–5 of paratype female; 10), allotype male in ventral view; 11), antennula and antenna of paratype male (taken with SEM); 12–14), variation of males in dorsal view; 15), young female from Puerto Rico (USNM 235988). Scale bar: 8 and 10 = 0.5 mm; 11 = 0.05 mm; 12–14 = 1.0 mm.



Figs. 16-22. Epicardium larva of *Probopyrus insularis* sp. nov. 16), antenna; 17), pereopod 1; 18), pereopod 4; 19), posterior edge of the fifth pleonite; 20), first pleopod; 21), fifth pleopod; 22), uropods. Scale bar: 0.05 mm.

the palp is rectangular and bears an undetermined number of setae. The palp of *P. pacificensis* is ovoid bearing 8 to 10 setae (Román-Contreras 1993), while the palp of *P. markhami* is pyramidal and bears a reduced number of setae (Román-Contreras 1996).

The pleon of males also has been used to differentiate some species of *Probopyrus*. However, the narrow pleon in males of *P. insularis* is not unique; it is comparable to that of *P. meeki*, and the gross structure of the pleotelson is similar to adult specimens of *P. meeki* as well as *P. markhami*.

In addition to structures of adult females and males, larval morphology of *Probopyrus* has been used to separate species (Dale & Anderson 1982). Although such features may prove to be important, mature larval stages are not always available to taxonomists.

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